14.—Host range and symptons in Western Australia of the gall rust, Uromycladium tepperianum

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Abstract

Sixty named host species of *Uromycladium tepperianum* (Sacc.) McAlpine collected during 1962, 1963 and 1964 in the south-west of Western Australia or noted from herbarium specimens are recorded for the first time, bringing the total of known hosts from 58 to 118. The possibility of extending the host range by artificial inoculation is indicated. For indigenous south-west Western Australian host species, the parts of the plants affected are indicated, together with gall type.

Introduction

The rust genus *Uromycladium* was erected by McAlpine in 1905 and included seven microcyclic species. No additional species have been described. McAlpine described the characteristic feature of the genus as "teleutospores borne in clusters, composed of one spore and cyst or two or more spores with or without a cyst, depressed globose and attached to a branched sporophore." The branched sporophore and sterile cyst are most unusual features in the rust teliospore. Of the seven known species of *Uromycladium* only two, *U. notabile* and *U. tepperianum*, induce gall formation in their hosts. *U. tepperianum* was originally described, illustrated and named as *Uromyces tepperianus* by Saccardo (1889), who thought that the unicelled teliospores were borne singly on unbranched sporophores. McAlpine (1905 p. 310) discovered that they were borne in clusters of three on branched sporophores. The rust is autoecious upon *Acacia* and *Albizzia* species and although the host range has been studied extensively in Eastern Australia, only a few hosts have hitherto been recorded in Western Australia. This paper records the results of a survey of the host range of *U. tepperianum* in the South-west botanical province of Western Australia. The data presented here were obtained during collecting trips over the years 1962-64 and during the course of study of all available material in the Western Australian Herbarium and the University Botany Department.

Host Species

U. tepperianum is parasitic on species of the two closely related genera *Acacia* and *Albizzia*. Within the genus *Acacia* it has a wide host range, a count made from the publications of various Eastern States' authors yielding fifty seven Australian species up to 1965 of which ten of the records are from Western Australia (nine species indigenous to that state; one species, *A. cyclopis*, A. Cunn. that occurs also in the Eastern States).

It has also been recorded on *Albizzia montana* Benth. from Java (McAlpine 1906 p. 112), so that the total number of recorded hosts prior to this study was fifty eight.

Table 1 lists the species recorded during this survey as hosts of *U. tepperianum*.

The number of natural Western Australian hosts of *U. tepperianum* is seventy, of which sixty nine are species of *Acacia*. Sixty of the seventy are new records. This represents approximately one quarter of the *Acacia* species occurring in the State. The occurrence of *Albizzia distachya* as a host is of interest because it is the first Australian record, and only the second species of this genus which has been observed to be infected by this rust.

Artificial Inoculation

Artificial inoculation would extend the host range still further, for example, two species: *Acacia brachystachya* Benth. and A. *microneura* Meissn., which have not been recorded previously as hosts were found to be susceptible to *U. tepperianum* under experimental conditions. Mature, uninjured phyllodes of these species were sprayed with water and then inoculated with mature teliospores of *U. tepperianum*. The inoculated phyllodes were placed in an erect position with their cut ends immersed in water and kept under humid conditions. Infection occurred and pycnia developed on the phyllodes of *A. brachystachya* Benth. within eight days, and *A. microneura* Meissn, within fifteen days, after inoculation. However, these species have not been found infected in the field, and are not entitled to inclusion in the host list. The phyllodes of another species, *A. longifolia* Willdt, which has been introduced into Western Australia from the East, developed pycnia eight days after inoculation. It has been recorded as a host in Eastern Australia (McAlpine 1906 p. 111) but infected trees were not found in Western Australia.

Thirteen species not recorded as hosts proved resistant on inoculation. These are *A. andrewsii*, W. G. Fitzg. *bidentata* Benth., *crassiuscula* Wendl., *cuneata* Benth., *dentifera* Benth., *dictyophleba* F. Muell., *lanuginosa* C. A. Gardn.,

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TABLE 1

Species recorded as hosts of Uromycladium tepperianum *in Western Australia with gall-type indicated.*

	Other States in which species found	Stem	Phyllode	Pedunele	Inflor-escence	Fruit
Acacia acanthoclada F. Muell.	S.A., Vict.	G				
A. aciphylla affin. Benth.		G				
A. acuaria W. V. Fitz.		G				
**A. acuminata* Benth.		G	G			
A. acutata W. V. Fitz.		G				
A. ancistrophylla C. Andrews		G	G			
A. beauverdiana Ewart and Sharman		G	G			
A. biflora R. Br.		G				
**A. birenosa* DC.		G				E
A. blakelyi Maid.		G				
A. brachyphylla Benth.		G				
A. cochlearis (Labill.) Wendl.		G				
A. cochlocarpa Meissn.		G	G			
A. colletioides A. Cunn. ex. Benth. var. *nyssophylla* (F. Muell). Benth.	S.A., Vic., N.S.W.	G				
A. cometes C. Andrews		G				G
A. coolgardiensis Maid.		G				
A. cupularis Domin		E				
**A. cyanophylla* Lindl.		G	G	G		G
**A. cyclops* A. Cunn. ex G. Don	S.A.	No galls found by present author				
A. dariesioides C. A. Gardn.		G				
A. decipiens (Koen.) R. Br.		G				
A. dielsii E. Pritzel		G				
A. divergens Benth.		G				
A. duriuscula W. V. Fitz.		G				
A. erinacea Benth.	S.A.	G				
**A. erioclada* Benth.		G				
**A. extensa* Lindl.		G				
A. fragilis Maid. and Blakely		G				
**A. glaucoptera* Benth.		No galls found by present author				
A. gonophylla Benth.		G				
A. hastulata Smith.		G				
A. intricata S. Moore		G				
A. ixiophylla Benth.	N.S.W., Qld.	E				
A. jibberdingensis Maid. and Blakely		G			G	
A. kochii W. V. Fitz. ex. Ewart and White		G				
A. lasiocalyx C. Andrews		G	G	G	G	
A. leptoneura Benth.		G				
A. leptopetala affin. Benth.	S.A., N.S.W., Qld.	G				
**A. ligustrina* Meissn.		G				
A. longiphyllodinea Maid.		Not specified				
A. merrallii F. Muell.	S.A.	E				
**A. merrallii* F. Muell. var. *tamminensis*. E. Pritzel		G				
A. multispicata Benth.		G				
A. myrtifolia (Smith) Willd. var. *angustifolia* Benth.		G				
A. neurophylla W. V. Fitz.		G				
A. nigricans (Labill.) R. Br.		G				
A. nigripilosa Maid.		G				
A. prainii Maid.	S.A.	G				
A. resinomarginea W. V. Fitz.		G				
A. restiacea Benth.		G				
A. rossei F. Muell.		G				
A. rostellifera Benth.		E				
A. scirpifolia Meissn.		G				
A. sclerosperma F. Muell.		G				
A. signata F. Muell.	S.A., N.T.	G		G	G	
A. spathulata F. Muell. ex .Benth.		G				
A. sphacelata Benth.		G				
A. stereophylla Meissn.		G				
**A. "stowardii" S. Moore*		Not examined by present author				
A. sulcata R. Br. var. *platyphylla* Maid. and Blakely		G				
A. tanumbirinense Maid.	Qld., N.T.	G				
A. teretifolia Benth.		G				
A. tratmaniana W. V. Fitz.		G				
A. trigonophylla Meissn.		G				
A. triptycha F. Muell. ex. Benth.		G				
A. tysonii Luehm.					G	
A. ulicina Meissn.		Not specified				
A. urophylla Benth. in Lindl.		G	G	G		
A. xerophila W. V. Fitz.		G				
Albizzia distachya (Vent.) MacBride,		G				

* recorded as hosts in W.A before this study began (Carne 1925) (MacNish 1963).
G indicates globose and E elongated, galls

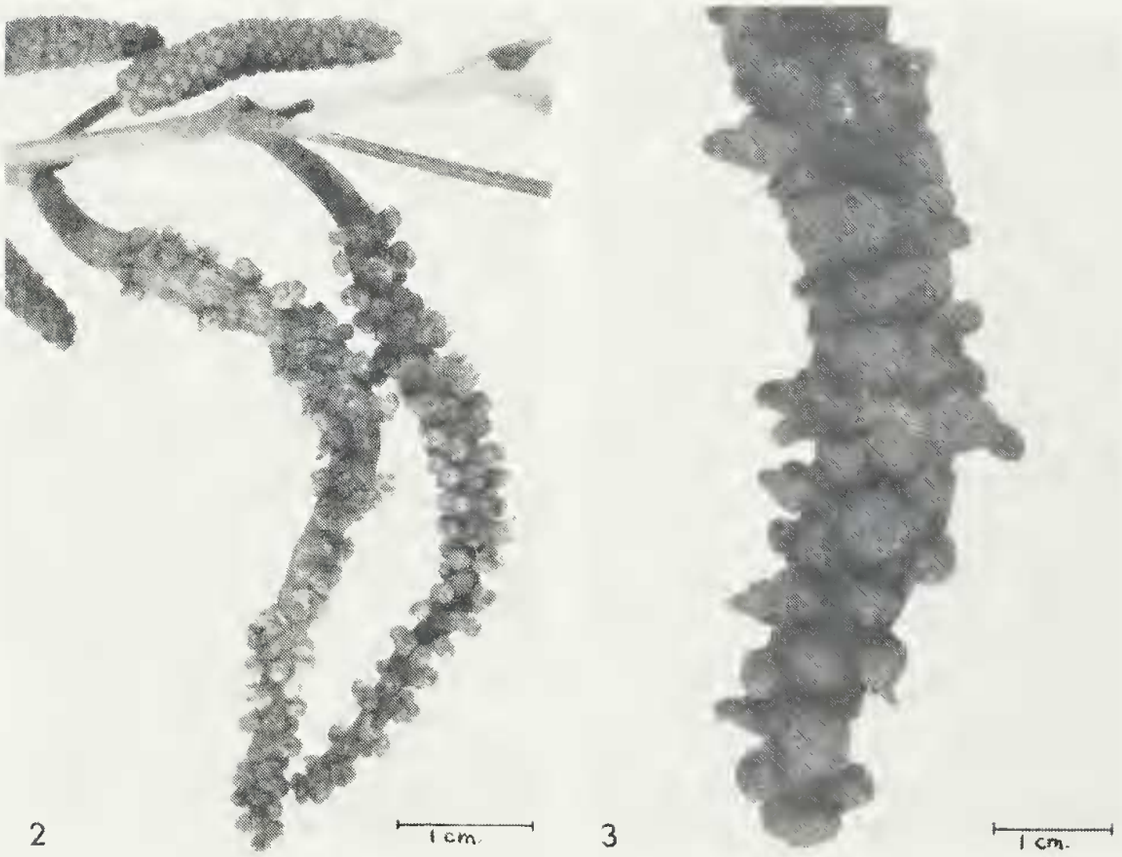

Figure 1.—Globose gall on the stem of an *A. cyanophylla*.

Figure 2.—Infected and uninfected inflorescences of *A. lasiocalyx*. The infected inflorescences are in the early stages of gall development. They are elongated and contorted, and flower opening is earlier than that occurring on a normal inflorescence.

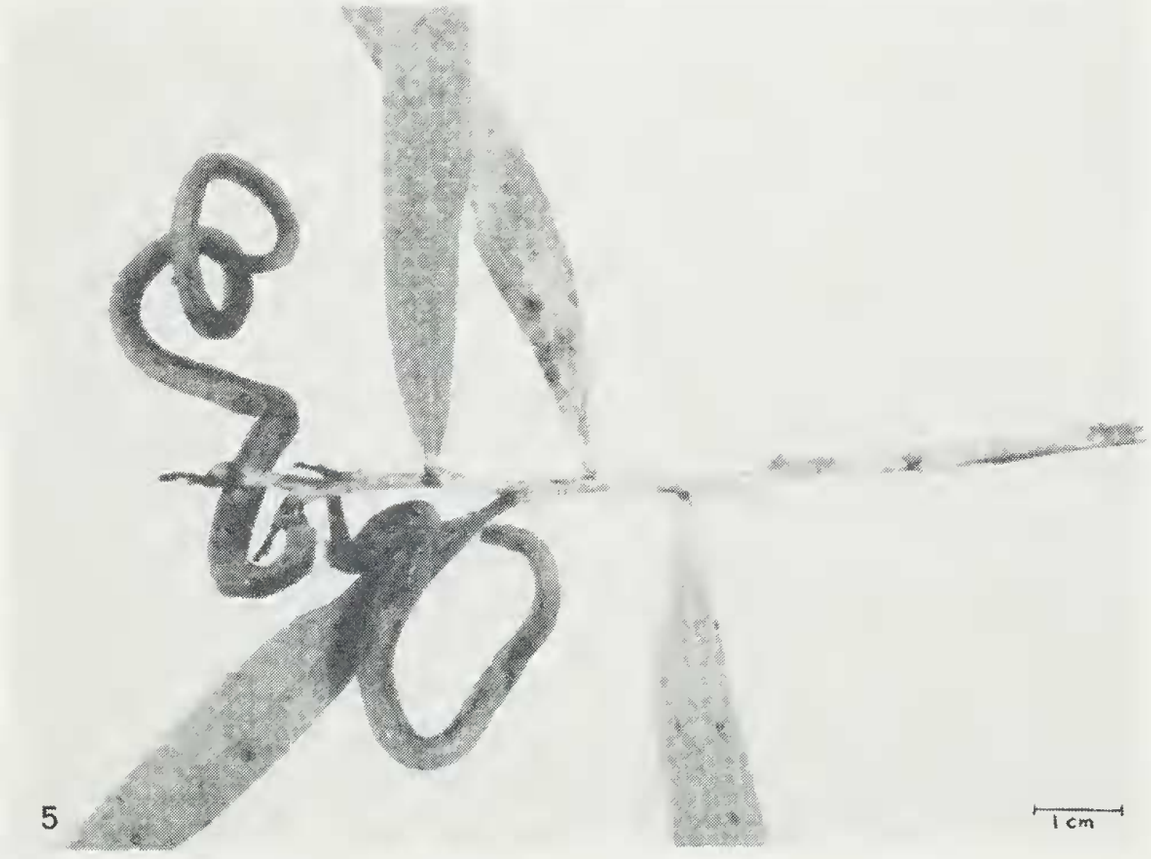

Figure 3.—A fully developed inflorescence gall of *A. lasiocalyx*. Abortive fruits are projecting from the main gall.
Figure 4.—An elongated stem gall on *A. rostellifera*. Galls develop at the point of branching of the stems. The old, larger galls occur towards the base of the plant.
Figure 5.—Long and twisted fruit galls of *A. bivenosa*.

lineolata Benth., *pilosa* Benth., *meissneri* Lehm. ex Meissn., *saligna* Wendl., *sowdenii* Maiden. *subcaerulea* Lindl.

Symptoms of the Disease

Conspicuous galls develop on the infected part of the host and in some instances witches' brooms and juvenile foliage may be produced. Severe infection by *U. tepperianum* ultimately results in the death of the host.

The types of galls which develop may be classified according to the shape of the gall and the organ which is affected. The galls may be globose or elongated, depending upon the extent to which the mycelium ramifies within the host tissue. In an elongated gall the fungus penetrates the host quite extensively, whereas in a globose gall the host reaction is more effective and restricts the parasite to a smaller area. The elongated and globose type of gall have not been found to occur on the one host species except for *A. bivenosa* (where different organs are involved) but appear to be mutually exclusive.

Stem, phyllode, peduncle and fruit galls have been observed on *A. cyanophylla*. Stem, phyllode, peduncle and inflorescence galls have been observed on *A. lasiocalyx*. Thus, in these two host species, *U. tepperianum* is capable of infecting and inducing gall formation in a number of organs. As all the galls are globose, the host reaction to parasitic invasion, in terms of localisation of mycelium, is apparently independent of the organ involved.

An examination of populations from widely separated areas at Geraldton, City Beach, Rockingham and Point Peron has revealed only stem galls in infected *A. rostellifera*. Similarly many fruit galls and one instance of a stem gall have been observed in populations of *A. bivenosa* plants investigated at Peppermint Grove, Reabold Hill and Fremantle. Thus the rust is consistent for the host part in which it induces gall formation, in any given species.

The reaction of *A. cyanophylla* does not vary with the part infected. Conspicuous perennial globose galls ranging in size from 0.5 cm. to 7.0 cm. in diameter develop.

Figure 1 shows a large stem gall on *A. cyanophylla*. Globose perennial galls develop on the stems and phyllodes of *A. lasiocalyx* in the same manner. When the young inflorescence of this species is infected its normal development is disturbed. There is an elongation and increase in the diameter of the spike which results in a separation of the individual flowers (Figure 2). Fertilisation and initial fruit development may occur in a very few flowers but in the majority, development is arrested before the flowers open. No mature seeds are produced. A gall measuring up to 13.0 cm. in length and 3.5 cm. in diameter with protruding abortive fruit may result (Figure 3).

Infection of *A. rostellifera* results in a perennial type of gall which is very different from that produced on *A. cyanophylla* or *A. lasiocalyx*, although the period of gall growth is very similar. The galls develop mainly at the points of branching of the stems and may measure as much as 18.0 cm. in length and 6.0 cm. in diameter. Thus the gall is an elongated structure with the greatest diameter in the central portion (Figure 4).

Very conspicuous twisted annual fruit galls develop in *A. bivenosa* as the result of infection of the ovary after fertilisation has occurred (Figure 5). Ovule development is arrested and no mature seeds are produced. Mature normal fruits may measure up to 25.0 cm. in length and 1.5 cm. in diameter.

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